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May 15, 1984

# Announcement of Opportunity

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LIFE SCIENCES INVESTIGATIONS IN SPACE  
1986-1991

PROPOSAL DUE DATES: October 1, 1984  
April 1, 1986  
October 1, 1987

BEST COPY AVAILABLE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C. 20546

ANNOUNCEMENT OF OPPORTUNITY

AO No. OSSA-2-84

Date: May 15, 1984

LIFE SCIENCES INVESTIGATIONS IN SPACE  
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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LIFE SCIENCES INVESTIGATIONS IN SPACE  
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I. Description of the Opportunity

The National Aeronautics and Space Administration (NASA) announces the opportunity for participation in scientific investigations in the life sciences which utilize the capabilities of the Space Shuttle. A number of Shuttle flight opportunities exist between 1986 and 1991 that can accommodate life sciences research in space. This Announcement describes these opportunities, the broad life sciences objectives which NASA seeks to support during this period, and the specific instructions and regulations governing the submittal, evaluation, and selection of life sciences flight investigations for support by NASA.

The purpose of this Announcement is to inform life sciences investigators of the opportunity to propose distinct and innovative approaches for addressing one or more of the objectives described in Section II. Such investigations should be capable of being carried out in space on Shuttle/Spacelab flights of 7 to 10 days duration. NASA is particularly interested in those investigations which are related to ensuring that a permanent human presence in space can be realized and sustained. Such a permanent presence is currently planned to begin in the early 1990's with the deployment of a manned space station.

Investigations selected as a result of this Announcement will normally be accommodated on Shuttle flights of the Spacelab pressurized module, but other modes of accommodation are possible and will be used if appropriate. The Spacelab pressurized module is a laboratory facility which is capable of supporting complex, interdisciplinary life sciences research in space. The crew for Spacelab missions can consist of highly trained research scientists as well as career astronauts. Spacelab flights are planned to occur a number of times between 1986 and 1991, and this Announcement solicits investigations appropriate for such missions. Some of these missions may be dedicated entirely to life sciences, while others may involve a sharing of the facilities of Spacelab among several scientific disciplines, including life sciences.

NASA has developed and will maintain a number of special facilities and an inventory of standard and specialized Life Sciences Laboratory Equipment (LSLE) to facilitate research in space, and these are described later in this Announcement. Investigators may propose to use these facilities and LSLE to



conduct their investigations, and are urged to do so if appropriate. Investigators may also propose to develop new equipment and instrumentation for space flight, and such proposals will be considered by NASA. Investigators should be aware that major flight equipment can require two to four years to develop and test, while minor modifications of existing equipment or development of simple items of new equipment can usually be accomplished in considerably less time.

A phased process will be used to select investigations submitted in response to this Announcement. Approximately one year after each proposal due date, investigators will be notified of the status of their proposals. Those investigations which are tentatively selected for space flight will undergo a 4 to 18 month definition study during which time investigators will interact strongly with Life Sciences Flight Experiments Project personnel at the appropriate NASA research center. During the definition phase, investigations will also be tentatively assigned to particular Shuttle flights. Such assignments will usually be made on the basis of compatibility or complementarity of investigations. Investigators and NASA personnel will then produce detailed experiment development plans and will conduct mission accommodation studies for each flight under consideration. Although purposeful overbooking of individual flights with the tentatively selected investigations will normally be avoided, the results of the accommodation studies may dictate reassignment of certain of the investigations to alternate flights. Finally, during the definition phase, NASA will form an Investigator Working Group (IWG) for each of the major missions under consideration.

Each IWG which is formed will be composed of Principal Investigators (or their representatives) assigned to a particular mission, and will be chaired by a NASA Mission Scientist. The primary purpose of the IWG is to assist NASA in developing sound mission plans, and to provide recommendations concerning the most appropriate actions to take to maximize the scientific yield of a mission. Each IWG will meet approximately twice yearly, and meetings will last about three days each. Subgroups of the IWG may be formed to address specific common concerns. Generally, these subgroups will meet once or twice a year, with meetings lasting for about two days. In addition, the IWG is responsible for determining the number and qualifications of any payload specialists who may be needed to operate the life sciences equipment and actually perform the investigations in space, and for recommending selection of the payload specialists. The IWG is also responsible for defining the requirements for crew training needed to carry out the flight investigations.

At the end of the definition phase, the experiment development plans, the mission accommodation studies, and other data (concerning programmatic priorities, budgetary limitations, alternate flight availability, etc.) will be used to make a final selection of those investigations which will be funded and developed for space flight. Final flight assignment will generally be made at the same time as final selection of investigations for space flight.

Since not all of the flight opportunities mentioned in this Announcement have been scheduled or funded at this time, this Announcement does not constitute an obligation on the part of the Government to carry any proposed effort to completion, flight assignment, or actual flight in space. Similarly, tentative selection of a proposal for flight does not guarantee a flight assignment.

## II. Announcement Objectives

Proposals submitted in response to this Announcement must address scientific questions related to one or both of the following objectives and must clearly require space flight for their accomplishment:

- o To investigate those areas of biomedical research which are concerned with the safety, well-being, comfort, and productivity of humans during space flight.
- o To investigate fundamental questions in biology.

The following are examples of scientific areas which are related to the first objective. This list is not meant to be all inclusive; it merely serves as an indication of the scope of that broad objective.

### Neurovestibular Function

Research which addresses the time course of the neurosensory and vestibular responses to space flight, including the changes in spatial orientation perception and equilibrium which occur during and after space flight. NASA is also particularly interested in those investigations which seek to determine the causes and means of prevention of space motion sickness.

### Cardiovascular and Pulmonary Function

Research which is concerned with the areas of hemodynamic adjustment during space flight, including cardiovascular mechanics and dynamics, fluid and electrolyte regulation, neurohormonal regulation, hematology, and pulmonary blood flow and ventilation.

### Musculoskeletal Function

Research which addresses the causes and time course of the adaptive changes in the musculoskeletal system which occur during space flight, including both bone loss and muscle alteration.

### Metabolism and Nutrition

Research which investigates general metabolic processes during space flight, including substrate and energy utilization, and digestive function.

### Human Capability and Performance

Research which is concerned with those elements which relate directly or indirectly to human productivity in the space flight environment, including the effects of lighting, work/rest cycles, nutrition, biological rhythms, task training, stress, altered sensory information and responses, and the interactions between man and machine.

## Clinical Medicine

Research in the area of health maintenance, including experiments directed at developing appropriate methods of prevention, diagnosis, and therapy in the environment of space, with particular emphasis on radiation protection, decompression sickness in microgravity, pharmacokinetic processes, and the development of surgical techniques suitable for space flight conditions.

## Countermeasures

Research related to the development and testing of countermeasures for the treatment of any untoward physiological changes which occur during or following space flight.

The second major objective addresses NASA's interest in those investigations which aim to develop an understanding of the role that gravity plays in the form and function of organisms on Earth. The following areas of research illustrate the types of investigations to be considered under this Announcement objective. This list is not meant to be complete.

### Identification and Characterization of the Gravity-Sensitive Mechanisms in Living Organisms

Research which is concerned with the identification of the sites of gravity reception, the mechanisms and systems involved in the transfer of gravitational information to responsive organs and structures, and in the characterization of the responses of the organisms to gravity. Gravity-sensitive mechanisms that may be involved in reproduction, differentiation, development, and maturation, among other things, are included in this category, as well as research directed towards understanding the evolutionary development of gravity-sensitive mechanisms and structures.

### Characterization of the Adaptive Responses of Living Organisms to the Microgravity of Space

Research which is concerned with the determination and examination of the adaptive, time-dependent morphological and physiological responses that occur in living organisms following entry into the environment of space and subsequent return to the normal environment of Earth, and with the development of mechanisms which relate these responses to biological or physiological function. Among other studies included in this category may be research directed towards the elucidation of gravity's role in interspecies and/or intra-species interactions with each other and/or with their environment.

### III. Background

#### A. Life Sciences Flight Experiments Program

The Flight Programs Branch of the NASA Life Sciences Division supports the broad objectives described in Section II through the development of appropriate equipment and facilities which allow life scientists to conduct medical, physiological, and biological experiments in the environment of space. In addition, this branch has the responsibility for managing all aspects of flight investigation selection, procurement, and hardware development for the Life Sciences Division. Life Sciences Flight Project Offices at Ames Research Center and Johnson Space Center carry out many of these tasks, particularly those related to flight hardware and protocol development.

Sophisticated, synergistic life sciences investigations using the latest laboratory equipment have been flown on the first Spacelab flight, and it is expected that such missions will continue to play a key role in life sciences research in space throughout this decade. The Spacelab module is a pressurized laboratory facility located in the Shuttle orbiter's cargo bay and attached to the orbiter cabin by a pressurized transfer tunnel. The module is designed to provide the resources required to conduct scientific investigations of a variety of types on space flights of 7 to 10 days' duration. The first Spacelab mission, completed in December, 1983, demonstrated clearly that the concept of such a space laboratory is a sound one. That mission carried investigations from a number of scientific disciplines, including life sciences. Sixteen of the Spacelab 1 investigations were from life sciences and involved human, cell, and plant specimens. It is currently planned that life sciences investigations will be accommodated in a number of future Spacelab flights, and, beginning in late 1985 or early 1986, certain Spacelab missions will be dedicated entirely to life sciences. Documents that contain details related to some of these missions may be found in the bibliography presented in Appendix A, where they are designated by the symbol "†".

The Shuttle offers a variety of accommodation options, in addition to or in place of the pressurized Spacelab module, and these other accommodation modes can be utilized for life sciences investigations, if appropriate. For example, occasional use is made of the Orbiter middeck area to perform critical hardware verification tests or to conduct simple life sciences studies in space. Other scientific disciplines have enclosed investigations within pressurized containers mounted on a platform in the Orbiter's cargo bay, an option that is also available to Life Sciences. In the future, the Flight Programs Branch expects to use all appropriate Shuttle facilities to conduct life sciences investigations in space.

#### B. Previous Life Sciences Studies in Space

Potential investigators are urged to become familiar with the relevant research prior to submitting a formal proposal to NASA. To aid potential investigators in this endeavor, a partial bibliography of studies in the space life sciences is presented in Appendix A.

#### IV. Proposal Opportunity Period

This Announcement will be in effect for four years with three proposal submission dates. In order to be assured of consideration, proposals must be received at the address listed in Section VI no later than 4:30 p.m. on the specified submission date. The submission dates are as follows:

Proposal Due Dates:   October 1, 1984  
                          April 1, 1986  
                          October 1, 1987

NASA reserves the right to modify and reissue this Announcement prior to the second and third proposal due dates listed above. Proposals received after any proposal due date will be treated according to the NASA policy for late proposals (see Section VII of Appendix C). A complete proposal submittal and selection schedule is given in Section VIII of this Announcement.

Investigations tentatively selected for flight following any proposal due date will normally be funded for definition soon after tentative selection takes place. However, if agreeable to the proposer, NASA may hold certain scientifically and technically sound investigations which cannot be funded immediately for later consideration and funding. Investigators who agree to allow their proposals to be retained in this manner should indicate this fact clearly in the cover letter submitted with their proposal. Investigators whose proposals are to be retained for consideration at a later time will be given the opportunity to revalidate their proposals with their sponsoring institutions and to update their cost data prior to being funded for definition.

#### V. Requirements and Constraints

Proposals submitted in response to this Announcement should be for life sciences experiments that require the unique environment of space for their execution, that address one or more of the objectives listed in Section II, and that can be performed using the capabilities of the Space Shuttle. Proposals must designate one individual as the Principal Investigator (PI) who will be the single point of contact with NASA and will assume the responsibility for conducting the selected investigation. The PI will be responsible for coordinating the activities of any team of Co-Investigators (Co-I's) required to carry out the actual research plan. Co-I's should be included as part of an investigative team only if they have specific and well-defined responsibilities. The responsibilities and contributions of the Co-I's must be clearly identified and justified in the proposal. The designation "Co-Principal Investigator" is not acceptable. Only the PI is eligible to serve as a member of any Investigator Working Group.

##### A. Space Shuttle Accommodations and Constraints

Life sciences flight experiments selected as a result of this Announcement will nominally be performed within a pressurized Spacelab module. As part of the evaluation process, NASA will examine alternate modes of accommodation and will determine the most appropriate accommodation mode for each investigation.



## B. Major Life Sciences Equipment

NASA has developed and will maintain an inventory of major scientific equipment and material expressly for use in life sciences investigations in space. This equipment is known as Life Sciences Laboratory Equipment (LSLE) and a detailed description of the LSLE currently available or under development is described in the "Guide to the Life Sciences Flight Experiments Program" which will be sent to those persons submitting a Notice of Intent to Propose (see Section VI).

This equipment is developed, acquired, and maintained by NASA for selection and integration into various laboratory designs, according to the needs of the investigations being flown. After each mission, the LSLE will be recovered, recertified for use in space, and stored for use in subsequent missions.

Proposers may request the use of this hardware for the development and operation of their flight investigations, and, in fact, are urged to do so whenever it is appropriate. Utilization of this hardware could result in reduced experiment cost and simplified individual experiment integration. (Integration is used here to refer to the process of folding distinct hardware elements of experiments together to form a larger flight element.) At the appropriate time in the development of an experiment for flight, NASA will provide a technical representative who will assist investigators in the integration of LSLE with their experiments.

In addition to the use of standard LSLE equipment, proposed investigations may also require the development of new scientific equipment, or the modification of existing equipment to fit the special needs of an investigation. The need for such development or modification should be fully justified in the proposal submitted. NASA reserves the right to require the use of U.S. Government furnished equipment in cases for which such equipment is available and appropriate for the proposed investigation.

New experiment hardware which is developed using NASA funds, either by the investigator or by NASA, will become a part of the LSLE inventory after the investigator has completed that part of the approved flight investigation and ground support studies requiring the hardware. These items remain the property of the U.S. Government and may be reused for later flights to support other experiment packages, or, if warranted, may be reflown under the aegis of the original investigator.

## C. Non-Human Specimen Accommodation

NASA recognizes the fact that, within the life sciences, diverse species are used for experimentation. Facilities currently exist which can accommodate frogs or toads, small rodents, small primates, and either dark-grown or photosynthetic seedlings during space flight. Other species required by investigators will be considered on an individual basis. NASA's decisions concerning the support of facilities modification or additional facilities development will be based on scientific justification, science priority, engineering feasibility, schedule considerations, and cost. Major facilities modifications or developments will require substantial justification. In all cases, investigators proposing the use of live vertebrate animals in research

must subscribe to the policies contained in the Principles for Use of Animals of the Public Health Service and also, in the case of warmblooded vertebrates, in the Guide for the Care and Use of Laboratory Animals (Department of Health and Human Services, NIH Publication No. 80-23 or subsequent revision). These documents are available from the Office for Protection from Research Risks, National Institutes of Health, Bethesda, MD 20205. Each proposal for research in which animals are used should contain a written assurance that the proposed research plan will adhere to the standards established by the Animal Welfare Acts and the above documents. Support for flight investigations involving the use of animals will be contingent upon approval for the planned research being obtained from the Animal Care and Use Committee at the Ames Research Center. Animals proposed for use on Shuttle should pose no health hazard to the crew, and investigations using animals will be reviewed by NASA prior to selection to ascertain that such is the case.

#### D. Human Experimentation in Space

Humans may be proposed as test subjects for investigations in life sciences. Shuttle missions will generally include a crew of four to seven persons. Such a crew will usually be composed of career astronauts (normally, a commander, a pilot, and one or more mission specialists) plus one or more payload specialists selected by the Investigator Working Group responsible for the mission in question. Payload specialists, and to a lesser extent, mission specialists, are available to be trained to conduct the scientific investigations during the actual mission. Investigators will be responsible for developing an appropriate training plan which will provide the crew with the skills required to accomplish the objectives of their investigation. Participation of the commander and pilot in flight investigation activities is normally severely limited.

In the case where humans are proposed as test subjects, proposals should describe any potential risks to the subjects arising from the conduct of the investigation, and should assess the likelihood and seriousness of such risks. In addition, proposals should describe procedures for protecting against or minimizing any potential risks, and should assess the effectiveness of these procedures. Proposed research activity relating to human subjects should be reviewed and approved by an appropriate institutional review board. If such a board does not exist at the investigator's institution, that fact should be clearly stated in the cover letter submitted with the proposal, and NASA will provide for the appropriate review. In addition, selected investigations using human subjects must be approved and periodically reviewed by the Human Research Policy and Procedures Committee at Johnson Space Center prior to their acceptance for flight.

#### E. Ground Support Facilities

NASA has developed a number of support facilities, particularly at Kennedy Space Center and Johnson Space Center, that are designed to provide the services generally required during space flight. These services include: communication during a mission; data collection just before, during, and immediately after a mission; and specimen accommodation just before and just after a mission. A description of these facilities is contained in the "Guide to the Life Sciences Flight Experiments Program."

## F. Mission Development/Completion Schedule

Activities proposed as Shuttle/Spacelab flight investigations should be consistent with the schedule shown in Table 1 which outlines those events associated with a typical Shuttle/Spacelab launch. Schedules for actual missions will be provided to investigators following their tentative selection and manifesting on such missions.

Key milestones in the development of a flight investigation depend, to some extent, upon the nature of the hardware required by the investigation in question. Generally, following tentative selection of an investigation (12 months after each proposal due date), investigators will be funded to complete a thorough science and implementation requirements definition study. This phase, which could last from 4-18 months depending upon the complexity of the investigation, is designed to produce a complete development plan for the investigation that is as realistic as possible. Investigators will work closely with NASA science and engineering personnel to produce this plan. At the end of this definition phase, investigators will submit updated science and implementation plans, including a development plan for any required hardware, and updated budgets. The updated science plan will reflect fine-tuning of the science plan contained in the original proposal, not a departure from the scope of the original investigation. Using these updated plans and other appropriate data, a final selection will be made of those investigations which will be funded and developed for space flight. This selection will be made by the NASA Associate Administrator for Space Science and Applications (see Section VII).

In preparation for final selection, NASA will carry out a flight accommodation study to determine whether the targeted Shuttle flights are capable of supporting the assigned payloads. Purposeful overbooking of flights will be avoided; hence, the accommodation studies may lead to the reassignment of certain investigations from one flight to another. Final flight assignment will generally be made at the same time as final selection of investigations for space flight. It is expected that most investigations which are selected for flight can be accommodated on missions that will occur from 2 to 5 years after the appropriate proposal due date.

## G. Data Analysis

All data, including required samples and specimens, related to an investigation will be supplied to an investigator as soon as feasible during or after a mission. The principal investigator is responsible for assuring that the data are reduced and analyzed in a timely manner. Approximately 90 days after receipt of data from any specific mission, principal investigators should be prepared to provide a preliminary report to NASA concerning the general findings of their investigations. In addition, at approximately one year after receipt of data, the principal investigator is responsible for providing all of the scientific data resulting from a space flight investigation, in a form usable by other scientists, for deposit in an appropriate repository. NASA will then release all such data to the public. Details related to the type of data records and data products to be deposited in the repository will be defined for each mission in a data management plan to be developed jointly by investigators and NASA scientists. Finally, investigators are expected to publish the results of their experiments in appropriate, peer reviewed, scientific journals.



Table 1

Schedule of Events Associated With a Typical Shuttle/Spacelab Launch\*

2-4 years prior to launch	-- Tentative selection -- Science and implementation requirements definition -- IWG meets -- Hardware preliminary design reviews
2 years prior to launch	-- Final investigation selection and payload confirmation -- Payload specialist selection and training
1-2 years prior to launch	-- Mission specialist selection and training
8 months prior to launch	-- Delivery of flight hardware to NASA Center (KSC) for integration
16-22 hours prior to launch	-- Completion of specimen loading, Spacelab module mode
4-6 hours prior to launch	-- Completion of loading for middeck experiments
1-3 hours following launch	-- Spacelab activation
7-9 days nominal	-- On-orbit operations
Up to 4 hours prior to landing	-- Spacelab deactivation, preparation for descent and landing
1-3 hours following landing	-- Specimen retrieval from Orbiter cabin
2-4 hours following landing	-- Specimen retrieval from Spacelab module
90 days following receipt of data	-- Preliminary PI report submitted to NASA

12 months following receipt of data -- Experiment data released into  
public domain  
Final experiment report submitted  
to NASA  
Mission Results Workshop or  
Symposium

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\*The times appearing in this table are estimates based on current schedules and experience. Investigators with different specimen loading and retrieval requirements should clearly specify and justify any such requirements in their proposal. These requirements will be evaluated against the current Shuttle/Spacelab schedule prior to selection.

NASA may require immediate release of selected data as deemed appropriate for public information while respecting the rights of investigators to first publication of their scientific results. The topics of data rights, protection of proprietary information, and title to experimental equipment and materials, as appropriate, will be subjects of agreement upon selection of an investigation for support by NASA, in accordance with NASA policies and regulations. Section XI of Appendix C contains additional information related to NASA policies concerning invention and data rights.

## VI. Proposal Submission Information

### A. Preproposal Activities

Those persons interested in responding to this Announcement of Opportunity should submit a Notice of Intent to Propose as early as possible, but no later than two months prior to the proposal due dates listed in Section IV. Due dates for such Notices are:

August 1, 1984 for the October 1, 1984 date,

February 1, 1986 for the April 1, 1986 date, and

August 1, 1987 for the October 1, 1987 date.

The Notice of Intent to Propose should contain the following information:

- o Name, title, affiliation, mailing address, and telephone number of the Principal Investigator and any Co-Investigators;
- o Experiment title;
- o Life Sciences discipline(s) selected from the list of disciplines contained in Appendix B; and
- o Description of proposed investigation. (This description should be no longer than one single-spaced typewritten page.)

This Notice of Intent to Propose should be submitted to:

Chief, Life Sciences Flight Experiments Program  
Code EBF-3 (AO No. OSSA-2-84)  
NASA Headquarters  
Washington, DC 20546

Foreign investigators should also send a copy of their Notice of Intent to Propose to:

International Affairs Division  
Code LID-18 (AO No. OSSA-2-84)  
NASA Headquarters  
Washington, DC 20546  
USA

Those persons submitting a Notice of Intent to Propose and any other persons requesting copies will be sent the "Guide to the Life Sciences Flight Experiments Program" and a set of worksheets which provides the minimal information required for the proper preparation of the mission accommodation portion of the proposal.

#### B. Format of Proposals

Proposals submitted in response to this Announcement must be prepared in accordance with the General Instructions and Provisions provided in Appendix C and the Guidelines for Proposal Preparation contained in Appendix D. Failure to follow these instructions and guidelines may preclude consideration of the proposal. Note particularly that all proposals shall consist of two distinct volumes: Volume I, containing the science investigation and technical plan; and Volume II, containing the mission accommodation requirements, and the management and cost plans. The cost plan is to be provided by U.S. proposers only.

Thirty (30) copies of proposals from investigators affiliated with domestic organizations should be submitted to:

Chief, Life Sciences Flight Experiments Program  
Code EBF-3 (AO No. OSSA-2-84)  
NASA Headquarters  
Washington, DC 20546

Thirty (30) copies of proposals from investigators affiliated with nondomestic organizations should be submitted to:

International Affairs Division  
Code LID-18 (AO No. OSSA-2-84)  
NASA Headquarters  
Washington, DC 20546  
USA

Additional guidelines applicable to non-U.S. proposers will be found in Appendix D.

### VII. Proposal Evaluation, Selection, and Implementation

#### A. Evaluation and Selection Procedure

Proposals received in response to this Announcement will be evaluated in accordance with the provisions of NASA NHB 8030.6A--"Guidelines for Acquisition of Investigations." Accordingly, the science investigation and technical plan from each proposal will be reviewed by panels of peers assembled by an independent, non-profit science organization acting on behalf of NASA. The purpose of this review is to assess the scientific and technical merit of the proposals in the context of this Announcement. Proposals will be further reviewed for implementation feasibility (mission accommodation requirements) and management approach (including schedule and cost aspects) by NASA personnel. Based on these reviews, a subcommittee of the NASA Space Science and Applications Steering Committee will classify each proposal into one of four categories:

Category I. Well conceived and scientifically and technically sound investigation pertinent to the goals of the program and the Announcement's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II. Well conceived and scientifically or technically sound investigation which is recommended for acceptance, but at a lower priority than Category I.

Category III. Scientifically or technically sound investigation which requires further development. Category III investigations may be funded for development and may be reconsidered at a later time for the same or other opportunities.

Category IV. Proposed investigation which is recommended for rejection for the particular opportunity under consideration, whatever the reason.

Following categorization and additional reviews by both the Life Sciences Program Office and the Space Sciences and Applications Steering Committee, the Associate Administrator for Space Science and Applications will tentatively select the investigations, taking into account the results of all of the above reviews as well as NASA's programmatic needs and Agency priorities. As indicated earlier, final confirmation of selection will follow the completion of an experiment definition study. Note that NASA has the option to contract in phases for a proposed experiment, and to discontinue the effort at the completion of any phase. NASA may also select only a portion of a proposed investigation, and may make a selection contingent upon an investigator joining with other investigators in a joint experiment. In such cases, an investigator will be given the opportunity to accept or decline such partial selection or participation with other investigators.

#### B. Evaluation Criteria

The fundamental goal of the investigation acquisition process is to identify unique ideas and capabilities which best suit the overall scientific objectives set forth in Section II. Therefore, the following criteria will be used in evaluating and selecting proposals submitted in response to this Announcement. They are listed in decreasing order of importance.

- o Scientific merits of the investigation.
- o Relevance of the investigation to the objectives contained in Section II of this Announcement.
- o Adequacy of the techniques, procedures, and instruments proposed with particular regard to their ability to supply the data needed to carry out the investigation.

- o Feasibility of implementing the investigation within the fiscal, engineering, operational, and schedule constraints.
- o Demonstrated competence and experience of investigators as an indication of their ability to carry the investigation to a successful conclusion.
- o Commitment and support of the investigator's institution in insuring that the investigation can be completed satisfactorily.

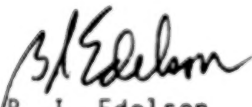
In addition to these criteria, cost and management will be considered in all selections. The cost attributed to a proposed investigation will include all costs to be borne by NASA for that investigation, including costs not covered by the proposal, such as NASA Flight Project support costs. Costs for such ancillary support services will be estimated by NASA as part of their management and cost review of each proposal.

#### VIII. Proposal Schedule

The following schedule is planned for the acquisition of investigations under this Announcement.

	<u>First Period</u>	<u>Second Period</u>	<u>Third Period</u>
Notice of Intent to Propose Due	August 1, 1984	February 1, 1986	August 1, 1987
Proposal Due Dates	October 1, 1984	April 1, 1986	October 1, 1987
Selection Announcement	November 1985	May 1987	November 1988

The frequent space flights of NASA's Shuttle will provide a major opportunity for conducting life sciences research in the unique environment of space throughout the 1980's and into the 1990's. It is expected that important new understandings of both basic and applied biological processes will be gained from the full use of the Shuttle's capabilities. I invite you to participate in this important and exciting endeavor.

  
 B. I. Edelson  
 Associate Administrator for  
 Space Science and Applications

## APPENDIX A

### SELECTED BIBLIOGRAPHY

Items denoted by an asterisk (\*) will be sent to those persons submitting a Notice of Intent to Propose. Items denoted by the symbol " † " refer to Spacelab missions.

- Am. Physiol. Soc. and NASA. Proc. of IUPS Commission on Gravitational Physiology. Suppl. to The Physiologist 22(6); Dec., 1979.
- Am. Physiol. Soc. and NASA. Proc. of 2nd IUPS Commission on Gravitational Physiology. Suppl. to The Physiologist 23(6); Dec., 1980.
- Am. Physiol. Soc. and NASA. Proc. of 3rd IUPS Commission on Gravitational Physiology. Suppl. to The Physiologist 24(6); Dec., 1981.
- Am. Physiol. Soc. and NASA. Proc. of 4th IUPS Commission on Gravitational Physiology. Suppl. to The Physiologist 25(6); Dec., 1982.
- Am. Physiol. Soc. and NASA. Proc. of 5th IUPS Commission on Gravitational Physiology. Suppl. to The Physiologist 26(6); Dec., 1983.
- The Apollo-Soyuz Test Project: Medical Report, ed. by A. E. Nicogossian, NASA SP-411, Washington, D.C., U.S. Government Printing Office, 1977.
- Biomedical Results of Apollo, ed. by R. S. Johnston, L. F. Dietlein, and C. A. Berry, NASA SP-368, Washington, D.C., U.S. Government Printing Office, 1975.
- Biomedical Results From Skylab, ed. by R. S. Johnston and L. F. Dietlein, NASA SP-377, Washington, D.C., U.S. Government Printing Office, 1977.
- Blomqvist, C. G., J. V. Nixon, R. L. Johnson, Jr. and J. H. Mitchell. Early cardiovascular adaptation to zero gravity simulated by head-down tilt. Acta Astronautica 7:543-553, 1980.
- Brown, A. H., A. O. Dahl and D. K. Chapman. Morphology of Arabidopsis grown under chronic centrifugation and on clinostat. Plant Physiol. 57:358-364, 1976.
- Cogoli, A., M. Valluchi-Morf, M. Mueller and W. Briegleb. Effect of hypogravity on human lymphocyte activation. Aviat. Space Environ. Med. 51:29-34, 1980.
- Dunn, C. D. R. and R. D. Lange. Erythropoietic effects of spaceflight. Acta Astronautica 6:725-732, 1979.
- Dunn, C. D. R. and R. D. Lange. The "anemia" of spaceflight: Some considerations from a potential animal model. Blood 25 (Suppl):202, 1978.



The Experiments of Biosatellite II, ed. by J. F. Saunders, NASA SP-204, Washington, D.C., U. S. Government Printing Office, 1971.

Gazenko, O. G., A. M. Genin, and A. D. Egorov. Summary of medical investigations in the U.S.S.R. manned space missions. Acta Astronautica 8:907-917, 1981.

Gazenko, O. G. and G. P. Parfenov. Third decade of Space Biology. JPRS, USSR Report: Space Biology and Aerospace Medicine. 16:1-10, 1982.

Hahn, P. M., T. Hoshizaki and W. R. Adey. Circadian rhythm of the Macaca nemestrina monkey in Biosatellite III. Aerospace Med. 42:295-304, 1971.

Hoffler, G. W. Cardiovascular studies of U. S. space crews: an overview and perspective. In Cardiovascular Flow Dynamics and Measurements, ed. by N. H. C. Hwang and N. A. Normann. Baltimore, University Park Press, 335-363, 1977.

Homick, J. L. Space motion sickness. Acta Astronautica 6:1259-1272, 1979.

Johnson, P. C. Fluid volume changes induced by space flight. Acta Astronautica 6:1335-1341, 1979.

Kimzey, S. L., J. I. Leonard and P. C. Johnson. A mathematical and experimental simulation of the hematological response to weightlessness. Acta Astronautica 6:1289-1303, 1979.

Kimzey, S. L. The effect of extended spaceflight on hematologic and immunologic systems. J. Am. Med. Women's Assoc. 30:218-232, 1975.

Klein, H. P. U.S. biological experiments in space. Acta Astronautica 8:927-938, 1981.

Lackner, J. R. and A. Graybiel. Etiological factors in space motion sickness. Aviat. Space Environ. Med. 54:675-681, 1983.

Leach, C. S. A review of the consequences of fluid and electrolyte shifts in weightlessness. Acta Astronautica 6:1123-1135, 1979.

Leach, C. S., P. C. Rambaut and N. DiFerrante. Amino aciduria in weightlessness. Acta Astronautica 6:1323-1333, 1979.

Leonard, J. I., C. S. Leach, and P. C. Rambaut. Quantitation of tissue loss during prolonged space flight. Am. J. Clin. Nutr. 38:667-679, 1983.

Levy, M. N. and J. M. Talbot. Cardiovascular deconditioning of space flight. Physiologist 26:297-303, 1983.

Michels, D. B. and J. B. West. Distribution of pulmonary ventilation and perfusion during short periods of weightlessness. J. Appl. Physiol.: Respirat. Environ. Exercise Physiol. 45:987-998, 1978.



- Morey, F. R. and D. J. Baylink. Inhibition of bone formation during spaceflight. Science 201:1138-1141, 1978.
- Nicogossian, A. E. and J. E. Parker. Space Physiology and Medicine. NASA SP-447, Washington, D.C., U.S. Government Printing Office, 1982.
- Osborne, D. J. Hormones and the growth of plants in response to gravity. Life Sciences and Space Research 14:37-45, 1976.
- Pace, N. Weightlessness: A matter of gravity. N. Engl. J. Med. 297: 32-37, 1977.
- Parfitt, A. M. Bone effects of space flight: Analysis by quantum concept of bone remodelling. Acta Astronautica 8:1083-1090, 1981.
- † Perry, T. W. and D. H. Reid. Spacelab mission four -- the first dedicated life sciences mission. Aviat. Space Environ. Med. 54:1123-1128, 1983.
- Rambaut, P. C. and R. S. Johnston. Prolonged weightlessness and calcium loss in man. Acta Astronautica 6:1113-1122, 1979.
- Reason, J. T. and J. J. Brand. Motion Sickness. London, Academic Press, 1975.
- † \* Rummel, J. A. Mission science requirements document - the first life sciences dedicated Spacelab mission, Part 1. JSC - 18295, June, 1982.
- Sandler, H. Effects of bedrest and weightlessness on the heart. In Hearts and Heart-like Organs, ed. by G. H. Bourne, Vol. 2, pp. 435-524, New York, Academic Press, 1980.
- † Science. Special Issue Devoted to Spacelab 1. To appear, July, 1984.
- Souza, K. A. The joint US-USSR biological satellite program. BioScience 29:160-166, 1979.
- \* Talbot, J. M. Research Opportunities in Space Motion Sickness. FASEB Report, Bethesda, MD, February, 1983.
- Tavassoli, M. Anemia of space flight. Blood 60:1059-1067, 1982.
- Taylor, G. R. Cell biology experiments conducted in space. BioScience 27:102-108, 1977.
- Tremor, J. W. and K. A. Souza. The influence of clinostat rotation on the fertilized amphibian egg. Space Life Sciences 3:179-191, 1972.
- Vinnikov, Ya A., O. G. Gazenko, L. K. Titova, A. A. Bronstein, V. I. Govardouskil, F. G. Gribaking, R. A. Peuzner, M. Z. Aroniva, T. A. Kharkeevich, T. P. Tsirulis, G. A. Pyatkina, D. V. Lichakou, L. P. Pal'mbach and V. F. Anichin. The structural and functional organization of the vestibular apparatus of rats exposed to weightlessness for 20 days onboard Sputnik "Kosmos-782". Acta Otolaryngol. 87: 90-96, 1979.

Von Baumgarten, R. J., G. Baldrighi, G. L. Schillinger, Jr., O. Harth, and R. Thuemler. Vestibular function in the space environment. Acta Astronautica. 2:49-58, 1974.

Young, R. S. Gravity and embryonic development. Life Sciences and Space Research 14:69-75, 1976.

## APPENDIX B

### DISCIPLINARY CLASSIFICATION

The major life sciences disciplines listed here are included solely for the purpose of preliminary classification of proposals submitted under this Announcement. In both the Notice of Intent to Propose and the proposal itself, one (or more) of these disciplines should be identified as the primary research area(s) involved in the investigation. In addition, each investigation should be further classified according to the particular area of interest that is most descriptive of its primary thrust. Investigators are free to select the most appropriate classification scheme within each major discipline listed.

Behavior, Performance, and Human Capability

Bioengineering and Life Support Systems

Clinical Medicine and Health Maintenance

Gravitational Biology

Physiology

Other (Specify)

[Specify major discipline and specific area  
of interest within that discipline]

## APPENDIX C

### GENERAL INSTRUCTIONS AND PROVISIONS

#### I. Instrumentation and/or Ground Equipment

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of Government instrumentation or property that subsequently becomes available, with or without modification, that will meet the investigative objectives.

#### II. Tentative Selections, Phased Development, Partial Selections, and Participation with Others

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment, and to discontinue the investigative effort at the completion of any phase. The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its team leader or contact point.

#### III. Selection Without Discussion or After Limited Discussion

The Government reserves the right to reject any or all proposals received in response to this Announcement when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion or after limited discussion. It is, therefore, emphasized that all proposals should be submitted initially on the most favorable terms that the offeror can submit.

#### IV. Foreign Proposals

Proposals for participation by individuals outside the U.S. should be submitted in the same format (excluding cost plans) as U.S. proposals. They should be typewritten and in English.

Foreign proposers must have their proposal reviewed and endorsed by the appropriate foreign government agency. Endorsed proposals should be forwarded to NASA to arrive before the Announcement deadline indicated under "Receipt of Proposals." "Notice of Intent" to propose should be sent directly to the office designated in the Announcement with a copy sent to NASA's International

Affairs Division. All other correspondence (including proposals and endorsements) from foreign proposers and organizations should be sent to:

International Affairs Division  
Code LID-18 (AO No. OSSA-2-84)  
NASA Headquarters  
Washington, DC 20546  
USA

Foreign proposals will go through the same evaluation and selection process as U.S. originated proposals. Should a proposal be selected, NASA will arrange with the sponsoring foreign agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the sponsoring agency will each bear the cost of discharging its respective responsibilities, including travel and subsistence of its own personnel.

V. Treatment of Proposal Data

The following will apply in the treatment of proposal data received in response to this Announcement:

a. Commercial and Financial Data

(1) It is NASA's policy to use commercial and financial data included in proposals for evaluation purposes only. This policy does not require that this kind of proposal data bear a notice.

(2) Where it is the practice of an offeror or proposed subcontractor to treat certain commercial and financial data as a trade secret, and such data is protectible as a trade secret under law, that offeror may apply the "Notice" of paragraph (b) below to those portions to be maintained as a trade secret.

(3) In any event, commercial and financial data submitted to NASA in a proposal will be protected to the extent permitted under the law, either as a properly noticed trade secret, or as commercial or financial information received from a person and considered confidential or privileged.

b. Technical Data

It is NASA's policy to use the technical data contained in any proposal submitted in response to this Announcement for evaluation purposes only. Where any of such technical data constitutes a trade secret under the law and the offeror, or potential subcontractor, desires to maintain trade secret rights in such technical data, the following "Notice" must be affixed to the cover sheet of the proposal specifying therein the pages of the proposal which contain trade secrets to be restricted in accordance with the conditions of the "Notice." Thereafter, it is NASA policy to protect such noticed technical data as a trade secret. NASA assumes no liability for use or disclosure of any proposal technical data to which the "Notice" has not been applied.

## NOTICE

Data on page \_\_\_\_\_ of this proposal constitute a trade secret. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, in the event a contract is awarded on this proposal, the Government may obtain in the contract additional rights to use and disclose this data.

### VI. Status of Cost Proposals (U.S. Proposals Only)

The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that following selection and during negotiations leading to a definitive contract, the institution will be required to resubmit or execute a DD Form 633 (Contract Pricing Proposal) and all certifications and representations required by law and regulation.

### VII. Late Proposals

The Government reserves the right to consider proposals or modifications thereof received after the date indicated for such purpose, but before award is made, should such action be in the interest of the Government.

### VIII. Source of Space Transportation System Investigations

Investigators are advised that candidate investigations for Space Transportation System (STS) missions can come from many sources. These sources include those selected through the Announcement of Opportunity, those generated by NASA in-house research and development and those derived from contracts and other agreements between NASA and external entities.

### IX. Disclosure of Proposals Outside Government

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desire to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

### X. Equal Opportunity (U.S. Proposals Only)

By submitting a proposal, the investigator and institution agree to accept the following clause in any resulting contract:

#### EQUAL OPPORTUNITY (JUNE 1973)

During the performance of this contract, the Contractor agrees as follows:



1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeships. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.

2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

3. The Contractor will send to each labor union or representative of workers with which the contractor has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency Contracting Officer, advising the labor union or workers' representative of the Contractor's commitments under this nondiscrimination clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The Contractor will comply with all provisions of Executive Order 11246 of September 14, 1965, as amended by Executive Order 11375 of October 13, 1967 and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The Contractor will furnish all information and reports required by Executive Order 11246 of September 14, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to the contractor's books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6. In the event of the Contractor's noncompliance with the Equal Opportunity clause of this contract or with any of the said rules, regulations, or orders, this contract may be cancelled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 14, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 14, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. The Contractor will include the provisions of Paragraph (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 14, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

#### XI. Invention and Data Rights

The following will be applicable to any contract resulting from a selection under this Announcement:

a. In instances where NASA totally or partially (cost shares) funds an investigation under a NASA contract, NASA is required by law to take title to inventions which may result from the work performed under the contract. The contractor would be granted a royalty free license to practice the invention. The contractor, however, could petition for waiver of such title in accordance with NASA Patent Waiver Regulations 14 C.F. R. 1245.1, whereupon the Agency would give favorable consideration towards waiving title to the invention to the contractor subject to the reservation by the Government of a royalty free license. As a general rule, the contract provides that NASA and the contractor can use and disclose, without restrictions, the data generated under the contract.

b. In instances where a joint project is undertaken, i.e., the investigator furnishes the experiment without charge to NASA, and NASA accommodates the experiment on a flight without charge (no transfer of funds takes place), NASA will obtain a royalty free license to practice for U.S. Governmental purposes any inventions resulting from the experiment, together with the right to use and disclose the resulting data for U.S. Governmental purposes.

#### XII. Hardware Flightworthiness

By submitting a proposal the investigator's institution understands that proposals selected which involve provision of flight experiment hardware will be required to comply with the flight mission's flightworthiness requirements. This must be accomplished by the organization managing the acquisition of the hardware. Flightworthiness requirements will be those to ensure necessary flight safety, and those to ensure a reasonable probability of satisfactory mission performance of the experiment hardware (reliability and quality assurance). Specifics of these requirements will vary from program to program. Investigators selected to provide experiment hardware will be advised of the pertinent flightworthiness requirements for the mission and experiment in a timely manner by the NASA Contracting Officer.



## APPENDIX D

### PROPOSAL FORMAT AND GUIDELINES FOR PROPOSAL PREPARATION

Proposals submitted in response to this Announcement of Opportunity must be in the format presented in this Appendix. Proposals which fail to follow the required format may be returned without further evaluation.

Proposals shall consist of two separate volumes. The first shall contain the Science Investigation and Technical Plan, while the second shall contain the Mission Accommodation Requirements, the Management Plan, and the Cost Plan (for U.S. proposers only). The Science Investigation and Technical Plan (Volume I) shall be limited to thirty (30) normal (8 1/2" x 11") single-spaced typewritten pages, using standard size type. In addition, Appendices and supporting documentation for this volume shall be limited to thirty (30) pages. The Science Investigation and Technical Plan should contain all of the information required to evaluate the scientific and technical merits of the proposed investigation, as only this volume will be reviewed by panels of peers. Volume II, which contains the Mission Accommodation Requirements, the Management Plan, and the Cost Plan, shall be limited to thirty (30) normal (8 1/2" x 11") single-spaced typewritten pages using standard size type, in addition to the set of worksheets mentioned below.

Thirty (30) copies of each proposal must be submitted. At least one complete and identified copy must be clear black and white, suitable for reproduction. A cover letter should be submitted with each proposal. It should be signed by both the principal investigator (one only), and by an official of the principal investigator's organization or institution who is authorized to commit the organization or institution that is responsible for the proposal and its contents. This cover letter should clearly indicate whether the investigator agrees to having his or her proposal held by NASA for later consideration and funding if it is considered scientifically and technically sound but is not selected for immediate support. Additionally, if the proposed research involves human subjects and if an appropriate institutional review board is not available to review the research plan, that fact should be stated in the cover letter.

In order to assist investigators in the completion of the Mission Accommodation Requirements contained in Volume II, a set of worksheets has been developed. These are not contained in this Announcement, but will be mailed to all those who submit a Notice of Intent to propose, and to any other interested parties who request them. The worksheets provide the minimal information required for the proper preparation of the Mission Accommodation section of the proposal.

ADDITIONAL GUIDELINES APPLICABLE TO NON-U.S. PROPOSERS ONLY

The following guidelines are established for foreign responses to NASA's Announcements of Opportunity. These guidelines indicate the appropriate measures to be taken by foreign proposers, prospective foreign sponsoring agencies, and NASA leading to the selection of a proposal and execution of appropriate arrangements. They include the following:

a. Where a "Notice of Intent" to propose is requested, prospective foreign proposers should write directly to the NASA official designated in the Announcement of Opportunity (see Section VI) and send a copy of this letter to the International Affairs Division, Code LID-18 (AO No. OSSA-2-84), NASA Headquarters, Washington, DC 20546, U.S.A.

b. Proposals will be submitted in accordance with the Guidelines for Proposal Preparation contained in this Appendix. Proposals should be type-written and in English.

c. Persons planning to submit a proposal should arrange with an appropriate foreign governmental agency for a review and endorsement of the proposed activity. Such endorsement by a foreign organization indicates:

- (1) The proposal merits careful consideration by NASA.
- (2) If the proposal is selected, sufficient funds will be available to undertake the activity envisioned.

d. Proposals (along with the requested number of copies) and letters of endorsement from the foreign governmental agency should be forwarded to NASA in time to arrive before the deadline established for each Announcement of Opportunity. These documents should be sent to the National Aeronautics and Space Administration, International Affairs Division, Code LID-18 (AO No. OSSA-2-84), NASA Headquarters, Washington, DC 20546, U.S.A.

e. All proposals should be received before the established closing date; those received after the closing date will be treated in accordance with NASA's provisions for late proposals. Sponsoring foreign governmental agencies, may, in exceptional situations, forward a proposal directly to the above address if review and endorsement is not possible before the announced closing date. In such cases, NASA should be advised when a decision on endorsement can be expected.

f. Shortly after the deadline for each Announcement of Opportunity, NASA's International Affairs Division will advise the appropriate sponsoring agency which proposals have been received and when the selection process should be completed. A copy of this acknowledgement will be provided to each proposer.

g. Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the Announcement of Opportunity. Copies of these letters will be sent to the sponsoring governmental agency.

h. NASA's International Affairs Division will then begin making the necessary arrangements to provide for the selectee's participation in the

appropriate NASA program. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (1) A letter of notification by NASA.
- (2) An exchange of letters between NASA and the sponsoring foreign governmental agency.
- (3) An agreement or Memorandum of Understanding between NASA and the sponsoring foreign governmental agency.

PROPOSAL OUTLINE

VOLUME I

SCIENCE INVESTIGATION AND TECHNICAL PLAN

1.0 INTRODUCTORY INFORMATION

1.1 Identifying Information

1.2 Table of Contents

1.3 Proposal Overview

2.0 SCIENCE INVESTIGATION AND TECHNICAL PLAN

2.1 Hypotheses and Objectives

2.2 Background, Significance, and Relevance

2.3 Justification for Conduct in Space

2.4 Experimental Design and Methods

2.4.1 Flight Investigation

2.4.2 Supporting Ground-Based Studies

2.5 Data Reduction and Analysis

2.6 Justification for Use of Experimental Subjects

2.7 Crew Support Requirements Summary

3.0 INSTRUMENTATION AND EQUIPMENT

3.1 Life Sciences Laboratory Equipment (LSLE)

3.2 New Instrumentation or Equipment

4.0 REFERENCES

APPENDIX A. PROJECT PERSONNEL

APPENDIX B. DATA ANALYSIS PLAN (if appropriate)

## INSTRUCTIONS

### VOLUME I\*

#### SCIENCE INVESTIGATION AND TECHNICAL PLAN

##### 1.0 INTRODUCTORY INFORMATION

This volume of the proposal shall begin with identifying and summary information as follows:

###### 1.1 Identifying Information

The proposal shall contain a title for the investigation, the names, addresses, and telephone numbers of a single principal investigator and any co-investigators, and the name of the supporting organization or institution.

###### 1.2 Table of Contents

A table of contents must be included for this volume of the proposal.

###### 1.3 Proposal Overview

This subsection should contain an overview of the proposed investigation which will be used for initial familiarization and classification by the appropriate peer group(s). It should contain the proposal title, one or more disciplines from the list in Appendix B of this Announcement, the experimental specimens used in the proposed investigation (genus/species, common name), a list of the major hardware items required for inflight use, and a brief (one page) description of the proposed investigation.

##### 2.0 SCIENCE INVESTIGATION AND TECHNICAL PLAN

This section should be used to set forth the objectives, background, approach, relevance and expected results of the proposed investigation. Because of the considerable expense of space flight experiments, it is important to be able to justify not only the objectives of the experiment, but also that part of the plan which specifies the total number of subjects required and, if applicable, the species to be used. The format for this plan is as follows.

\*This volume should contain all of the information required to evaluate the scientific and technical merits of the investigation, and the relevance of the investigation to the objectives in Section II of this Announcement.

## 2.1 Hypotheses and Objectives

Define the objectives or goals of the proposed research and specify what hypotheses are to be tested. Relate the specific objectives of the investigation to the hypotheses being tested.

## 2.2 Background, Significance, and Relevance

Discuss the background to the present proposal in some depth. Relate the value of the hypotheses and objectives to past, current and future efforts in the discipline field. Critically evaluate existing knowledge, and specifically identify the gaps which the investigation is intended to fill.

Succinctly state how this investigation and its expected results relate to the objectives of the Announcement of Opportunity and the NASA Life Sciences Program in general.

## 2.3 Justification for Conduct in Space

Demonstrate the need for such an investigation in general, and specifically justify the need for the environment of space in order to accomplish the proposed investigation.

## 2.4 Experimental Design and Methods

In each of the two subsections which follow, the experimental design and the procedures to be used to accomplish the specific objectives of the investigation should be described and discussed. Items, such as the limitations and difficulties of the proposed procedures and alternatives which might achieve the same aims and the hazards that the proposed procedures, situations, or material may pose to the flight crew acting as either experimenters or subjects, should be discussed. Advantages of new methodologies over existing methodologies should be described and discussed. These subsections should also clearly identify the specific measurements that will be required during this investigation. A detailed discussion of the design and developmental status of any flight instrumentation or special experimental equipment required for this investigation should be provided in Section 3.0 on Instrumentation and Equipment.

### 2.4.1 Flight Investigation

Provide a description of that portion of the investigation that is to be performed during space flight. Pre- and postflight segments which are related to the inflight portion of the experiment are considered part of the flight study as are any required pre-, in-, and postflight ground operations and testing, and all should be fully described in this section. The developmental status of the flight experiment should be described in terms of whether its concept and required hardware have been tested in previous



space flight or ground-based studies. Certain investigations lend themselves to a subdivision into separate parts which can or should be performed on different space flights, and these parts should be clearly identified and described in this subsection. Judicious subdivision of a complex investigation might permit a portion of an investigation to be scheduled for flight sooner than would be possible for the entire investigation, and the appropriate subdivision by the investigator will facilitate making flight assignments for each part without sacrificing the integrity of the experiment.

#### 2.4.2 Supporting Ground-Based Studies

Certain supporting studies may be required in many investigations, even in those that are almost ready for space flight. Each supporting study should be identified and described separately in this subsection. In particular, the description of each supporting study should include hypotheses, objectives, experimental design, developmental status, and relevance and significance to the overall study.

#### 2.5 Data Reduction and Analysis

Provide a discussion of the data reduction and analysis plan. The proposal should describe the approach that will be used for the analysis of the results, and the testing of the hypotheses. Describe the quantitative basis (statistical or otherwise) for choosing the subjects (number, homogeneity), samples (number, frequency), and experimental controls. Indicate any unusual methods of data analysis, including the use of mathematical models. Details of the data analysis plan may be placed in Appendix B to this volume.

#### 2.6 Justification for Use of Experimental Subjects

If vertebrate animals have been identified as subjects, justify their use and provide a specific rationale for their selection and number. Describe the procedures for adequate maintenance and veterinary care of any animals involved. Describe the procedures that will be taken to avoid unnecessary discomfort, pain, or injury to the animals. In all cases, investigators proposing the use of live vertebrate animals in research must subscribe to the policies contained in the Principles for Use of Animals of the Public Health Service and also, in the case of warmblooded vertebrates, in the Guide for the Care and Use of Laboratory Animals (Department of Health and Human Services, NIH Publication No. 80-23 or subsequent revision). These documents are available from the Office for Protection from Research Risks, National Institutes of Health, Bethesda, MD 20205.

In cases where humans are to be used as test subjects, describe any potential risks (physical, psychological, social, legal, or other)

and assess their likelihood and seriousness. Describe the procedures for protecting against or minimizing any potential risks, and assess their likely effectiveness. Where appropriate, describe the provisions for monitoring the data collected to insure the safety of subjects. Also discuss why the risks to the subjects are reasonable in relation to the anticipated benefits to the subjects and in relation to the importance of the knowledge that may reasonably be expected to result. Research activity relating to human subjects should be reviewed and approved by an appropriate institutional review board, and a statement indicating that this review has occurred should be included in the proposal. If such a board does not exist at the investigator's institution, that fact should be stated in this section, as well as in the cover letter submitted with the proposal, and NASA will provide for the appropriate review.

### 2.7 Crew Support Requirements Summary

Summarize the requirements for the crew support of the investigation before, during, and after the mission. Identify any unique skills required by the crew in order to accomplish the investigation. This section should be consistent with Sections 2.2.2 and 2.3.3 of Volume II.

## 3.0 INSTRUMENTATION AND EQUIPMENT

This section should list all major items of equipment or instrumentation necessary to accomplish the proposed investigation. The adequacy and appropriateness of each required major hardware element to actually supply the samples or data needed should be justified. Each major instrument or item of equipment and its performance characteristics should be related directly to the objectives of the investigation contained in Section 2.1 of this volume.

### 3.1 Life Sciences Laboratory Equipment (LSLE)

Major required instrumentation and equipment that already exists as Life Sciences Laboratory Equipment (LSLE) should be placed in this section. The "Guide to the Life Sciences Flight Experiments Program" provides a description of the LSLE currently available.

### 3.2 New Instrumentation or Equipment

This section should discuss new items of equipment or instrumentation that need to be developed in order to conduct the proposed investigation. Full justification should be provided for each such item. A clear distinction should be made between those items which are modifications of standard LSLE, and those items which are not. In the latter case, a full description of the design and the developmental status of the item should be provided.



#### 4.0 REFERENCES

List complete literature citations in this section. Each complete literature citation must include the names of all authors, the name of the book or journal, volume number, page numbers, and the year of publication. Providing titles is useful but optional. Every attempt should be made to compile an accurate, relevant, and current, but not exhaustive, bibliography. Include citations of all previous contracts, grants, flight experiments, or ground-based studies conducted by the principal or co-investigators that directly relate to the investigation.

#### APPENDIX A. PROJECT PERSONNEL

Provide resumés for principal investigators, co-investigators, and other key project personnel. Each resumé should set forth:

- a) Education
- b) Relevant professional/technical experience
- c) Relevant publications and reports
- d) Honors, awards, and memberships.

#### APPENDIX B. DATA ANALYSIS PLAN (if appropriate)

Details of the data analysis plan summarized in Section 2.5 above may be placed in this appendix.

PROPOSAL OUTLINE

VOLUME II

MISSION ACCOMMODATION REQUIREMENTS AND THE MANAGEMENT AND COST PLANS

1.0 INTRODUCTORY INFORMATION

1.1 Identifying Information

1.2 Table of Contents

1.3 Proposal Overview

2.0 MISSION ACCOMMODATION REQUIREMENTS

2.1 Mission Requirements

2.2 Crew and Specimen Requirements

2.2.1 Human Subjects

2.2.2 Other Crew Requirements

2.2.3 Nonhuman Specimens

2.3 Experimental Procedures

2.3.1 Inflight Crew Time Requirements

2.3.2 Pre- and Postflight Ground Operations Support Requirements

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2.4 Data Management Requirements

2.5 Communication Requirements

2.6 Facilities and Equipment Requirements

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2.8 Critical Accommodation Constraints

3.0 MANAGEMENT PLAN

4.0 COST PLAN (U.S. INVESTIGATIONS ONLY)

## INSTRUCTIONS

3

### VOLUME II

#### MISSION ACCOMMODATION REQUIREMENTS AND MANAGEMENT AND COST PLANS

##### 1.0 INTRODUCTORY INFORMATION

This volume of the proposal shall begin with identifying and summary information identical to that in Volume I, Section 1.0, but shall include its own Table of Contents.

##### 2.0 MISSION ACCOMMODATION REQUIREMENTS

This section should demonstrate the engineering feasibility of conducting the proposed investigation in a flight environment and should permit an assessment of the compatibility of the experiment with the mission constraints. Those factors required to make an experiment suitable for space flight should be provided in this section. These include requirements for flight operations, crew training, and data acquisition and handling, as well as descriptions of major hardware items and the need for special facilities. NASA realizes that much of the information requested in this section may be known only in a qualitative sense; thus, flight experiments tentatively selected as a result of this Announcement of Opportunity will undergo detailed implementation planning and definition before final selection and assignment to a specific mission. However, to be selected for implementation planning and further definition, a proposed experiment must not only be technically feasible but must also be capable of being accommodated on Shuttle/Spacelab, and the purpose of this section is to provide the information required to determine if such is the case.

In order to assist investigators in supplying this information, a set of worksheets will be provided to those submitting a Notice of Intent to Propose. The completion of these worksheets will provide the necessary implementation, operational and crew requirements for the investigation and will constitute the minimal information for this section. The descriptions provided below indicate the generic type of information required by the worksheets.

##### 2.1 Mission Requirements

This section should provide the number of missions required to accomplish the proposed investigation and any constraints that exist on mission duration, or launch and landing schedules because of this investigation. If multiple missions are required only because of sample size requirements, that fact should be clearly stated. Any special mission features (special orbits, extravehicular activity, etc.) required by the investigation should be identified.

## 2.2 Crew and Specimen Requirements

Identify all of the subjects required for the experiment.

### 2.2.1 Human Subjects

State the number of human subjects required to serve as test subjects in your experiment during the flight portion of the study. Identify any special restrictions imposed upon the crew (such as diet, work/sleep cycles, and exercise requirements, etc.), or any special requirements (such as gender, age, etc.) placed upon crew selection.

### 2.2.2 Other Crew Requirements

Provide a brief description of all tasks required of the crew before, during, and after flight, and include in the description a list of any special equipment the crew will use. Identify any special qualifications the crew must have in order to complete the required tasks.

### 2.2.3 Nonhuman Specimens

Identify any nonhuman specimens that your experiment requires during the flight portion of the study, including cells, tissues, microorganisms, plants, invertebrates, and vertebrates. As may be appropriate, specify the species name (scientific and common), the number required, age, weight, gender, etc. Also, identify any special requirements for feeding, collecting waste products, or handling.

## 2.3 Experimental Procedures

This section provides a description of the manner in which data are to be collected in space, an estimate of the crew time required to collect that data, and a discussion of the training required in order for the crew to be able to collect that data.

### 2.3.1 Inflight Crew Time Requirements

Divide the flight portion of the experimental study into distinct procedures (i.e., independent, time-continuous operations or events resulting in specific samples or measurements). Provide a brief description of each procedure along with the following information: the schedule of procedure performance (mission day, time, and number of repetitions per day) and any scheduling constraints, the number of crewmembers involved, the type of measurements or samples expected, and the equipment necessary. Based on your laboratory experience, estimate the amount of time required to complete each procedure. Do not make special time allowances for the fact that the investigation will be performed in the nearly weightless environment of space.

### 2.3.2 Pre- and Postflight Ground Operations Support Requirements

Briefly summarize the pre- and postflight procedures required to accomplish the proposed flight investigation. Specify whether crewmembers are required for these non-flight activities. Describe other ground support activities (e.g., normal animal care) that are required.

### 2.3.3 Crew Training Requirements

Provide an estimate of the number and duration of the training sessions required in order for the crew to develop the appropriate level of proficiency to complete the tasks required of the crew. List any requirements or assumptions related to each crewmember's (Commander, Pilot, Mission Specialist, Payload Specialist) educational background used to develop this estimate. Any special equipment required for training, and any special constraints on the location of the training sessions should be described.

## 2.4 Data Management Requirements

Describe briefly the spacecraft capabilities required to collect and manage the data necessary to the investigation. This description should include voice, video, photographic, analog, and/or digital data recording requirements along with any requirements for onboard data display or processing and automatic (computer) control of experimental equipment.

## 2.5 Communication Requirements

Identify and describe the need for transmission of experimental data from the spacecraft to ground systems during the mission. Describe any requirement which exists for direct voice or video transmissions during the space flight, and for interaction between ground personnel and the flight crew. Provide a justification for any such requirement.

## 2.6 Facilities and Equipment Requirements

Identify all major facilities, laboratory equipment, and ground support equipment at both NASA and non-NASA locations that are essential to the flight portion of the experiment (preflight, in-flight and postflight) if these are known. The proposer should identify whether the inflight equipment will be provided by NASA's Life Sciences Laboratory Equipment (LSLE) inventory, or be constructed uniquely for or by the investigator. In the latter case, specify the function, performance characteristics, and development status of each major item of equipment as fully as possible. This data must be complete in itself without need to request additional data. Failure to furnish complete data may preclude evaluation of the proposal. Investigators wishing NASA to develop and supply the required hardware should so indicate. Those investigators proposing to supply hardware items should include a

hardware acquisition plan as part of the management plan (Section 3.0 of this volume).

## 2.7 Special Requirements

Specify the need for any special facilities that are available on the Shuttle/Spacelab system. These include an airlock, high quality optical window, vacuum or processing chambers, or the direct exposure to a space vacuum environment.

## 2.8 Critical Accommodation Constraints

Summarize all of the major accommodation constraints that are critical to the timely and/or successful completion of the investigation (e.g., hardware redesign or development, potential crew-time limitations, level of crew training, development of special flight handling techniques). In particular, address the compatibility of the experiment with respect to the spacecraft environment and the constraints the experiment may impose on the performance of other life science experiments or on Shuttle or mission operations. Any restrictions on crew extravehicular activity, the use of Shuttle control thrusters, lighting, noise level, or vibration level should be described in this section.

## 3.0 MANAGEMENT PLAN

The management plan should summarize the management approach proposed for the coordination of the various elements involved in the overall investigation and should recognize the essential functions of management and the integration of these functions.

This plan should give insight into the organization proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with NASA, major subcontractors, and associated investigators. Likewise, the management plan should present the various schedules necessary for the logical and timely pursuit of the work plan, and it should present and discuss the responsibilities of the co-investigators.

Although NASA will make the final decision as to the method(s) of hardware acquisition, those investigators proposing to supply hardware items should include a hardware acquisition plan as part of the management plan. Investigators desiring NASA to develop and supply the required hardware should so indicate. When a hardware acquisition plan is submitted, it should include the following, as applicable:

- (1) The rationale for the investigator to obtain the experiment hardware through or by his institution.
- (2) The method and basis for the selection of the proposed experiment hardware fabricator.
- (3) The unique or proprietary capabilities of the experiment hardware fabricator that are not available from any other source.



- (4) The contributions or characteristics of the proposed fabricator's experiment hardware that make it an inseparable part of the investigation.
- (5) Availability and experience of supporting personnel in the institution for successful administration of the experiment hardware contract and for technical monitoring of the hardware fabrication.
- (6) The status of development of the experimental hardware, identifying areas that need further design or in which unknowns are present.
- (7) A description of the method by which the investigator proposes to:
  - (a) Prepare experiment hardware specifications.
  - (b) Review development progress.
  - (c) Review design and fabrication changes.
  - (d) Participate in the testing program.
  - (e) Perform final checkout and calibration.
  - (f) Ship the equipment to the NASA center for integration into the payload.
  - (g) Support the flight operations.
  - (h) Coordinate with co-investigators, spacecraft contractor, and other related investigations.
  - (i) Execute tasks for the assurance of safety, reliability, and quality.
- (8) Provide for the participation by small and/or minority business in any subcontracting for experiment hardware fabrication or investigative support functions.
- (9) Prepare and update a work breakdown structure and a schedule for completion.

#### 4.0 COST PLAN (U.S. INVESTIGATIONS ONLY)

The cost plan should summarize the major categories of cost involved in the total investigation contained in the proposal. Separate major category cost summaries must be provided for flight studies (defined in Section 2.4.1 of Volume I of the proposal) and for supporting ground-based studies (defined in Section 2.4.2 of Volume I). The categories of cost should include the following:

- (1) Direct Labor. List by labor category, with man-hours and rates for each. Provide actual salaries of all personnel and the percentage of time each individual will devote to the effort.

- (2) Overhead. Include indirect cost, which because of its incurrence for common or joint objectives, is not readily subject to treatment as a direct cost. Usually this is in the form of a percentage of the direct labor costs.
- (3) Materials. This should give the total cost of the bill of materials, including estimated cost of each major item. Include lead time of critical items.
- (4) Subcontracts. If any, list those over \$25,000, specify the vendor, and the basis for estimated costs. Include any baseline or supporting studies.
- (5) Special Equipment. Include a list of special equipment and lead and/or development time.
- (6) Travel. List estimated number of trips, destinations, duration, purpose, number of travelers, and anticipated dates.
- (7) Other costs. Costs not covered elsewhere.
- (8) General and Administrative Expense. This includes the expenses of the institution's general and executive offices and other miscellaneous expenses related to the overall business.
- (9) Fee (if applicable).
- (10) Cost-Sharing Arrangement (if any). Any cost-sharing considerations or provisions of the sponsoring institution should be included here.

The cost plan should contain separate schedules, in the above format, to show total costs allocatable to the following:

- (1) Principal investigator and other investigator's costs.
- (2) Instrument costs.
- (3) Ground Support Equipment (including checkout equipment).
- (4) Data reduction and analysis, including the amount and cost of computer time.

If the effort is sufficiently known and defined, a funding obligation plan which provides the proposed funding requirements of the investigation by quarter and/or annum keyed to the work schedule should be included as part of the cost plan.



**END**

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